Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (COMPUTER NETWORKING AND ENGINEERING/SOFTWARE ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2019

SUBJECT: ADVANCED DATA STRUCTURES AND ALGORITHMS [ICT 5151]

REVISED CREDIT SYSTEM

(15/11/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data, if any, may be suitably assumed.

1A. Consider the graph given in Fig.Q.1A. Determine the maximum amount of flow that can be sent from the source node to the sink node. **5**

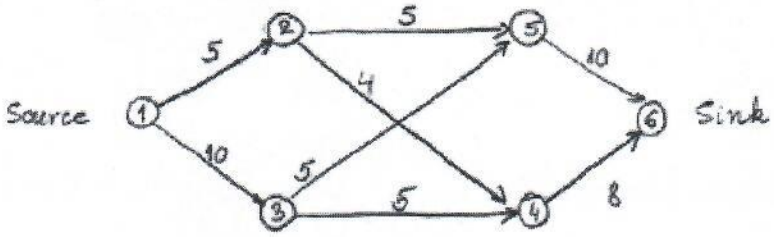

Fig.Q.1A

1B. Write the resultant tree after inserting the element 17 into the AVL tree given in Fig.Q.1B. **3**

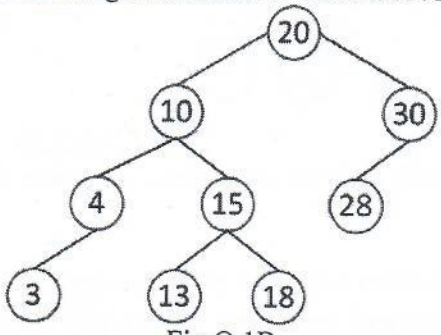

Fig.Q.1B

1C. Analyse the time complexity of following code: **2**

```
int i, j, k = 0;
for (i = n / 2; i <= n; i++) {
   for (j = 2; j <= n; j = j * 2) {
      k = k + n / 2;
   }
}
```

2A. Discuss the efficient method to multiply two n-bit numbers which uses Divide and Conquer strategy and analyse its time complexity. Demonstrate the working of the method to multiply two 4-bit numbers. **5**

2B. Show that N inserts into an initially empty binomial queue takes O(N) time in the worst case. **3**

2C. What are randomized algorithms? Explain how randomness can be incorporated in skip lists. **2**

3A. Given the keys and their probabilities as shown in Table Q.3A, Construct an Optimal Binary Search Tree. Show all the intermediate computations.Which design technique does it follow? **5**

Table Q.3A

Keys	1	2	3	4	5
Probabilities	.25	.2	.05	.2	.3

3B. Discuss the Smart Find operation which uses path compression in a Disjoint set ADT. Consider the disjoint set shown in Fig.Q.3B. Demonstrate the Find(e) operation. **3**

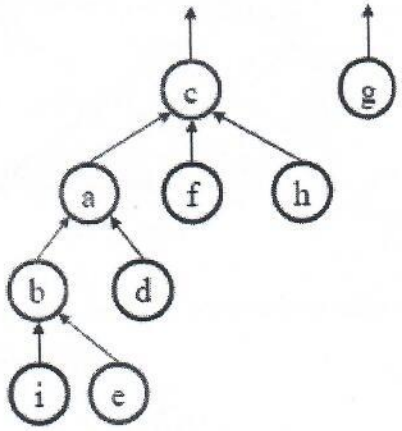

Fig.Q.3B.

3C. Write the pseudo code for *delete_min* operation in a Fibonacci heap and discuss its time complexity. **2**

4A. Discuss the Dijkstra's shortest path algorithm. Considering the graph given in Fig. Q.4A, find the shortest path from node 1 to all other nodes. **5**

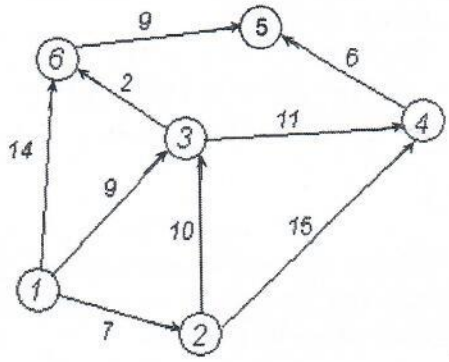

Fig. Q.4A

4B. Insert the values 1,2,5,4,6,3,7,8,9 in that order into a initially empty B-Tree with M=3. **3**

4C. The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function h(k) = k mod 10 and linear probing. Write the resultant hash table. **2**

5A. Write the complete pseudo code for sorting a list of integers using merge sort. Trace the code for a sample list containing 10 elements. Analse the complexity of Merge sort by writing a recurrence relation and solving it. **5**

5B. Consider two skew heaps H1 and H2 given in Fig. Q.5B. Merge the two heaps into a single skew heap. Show all the steps clearly. **3**

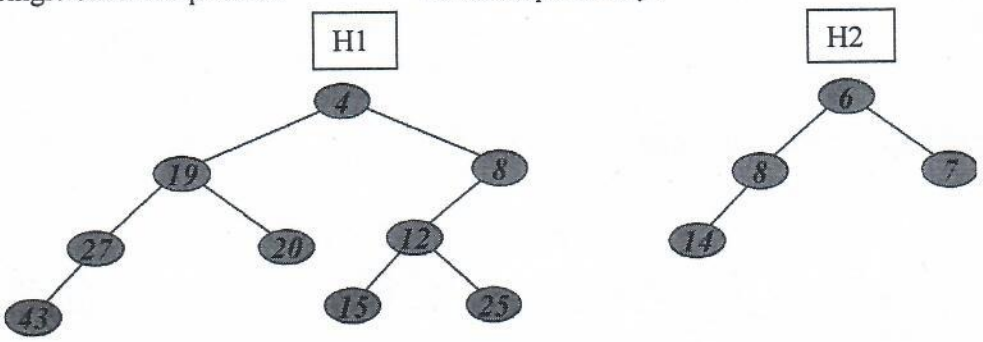

Fig.Q.5B

5C. Consider the splay Tree given in Fig.Q.5C. Show the steps in deleting node 30. **2**

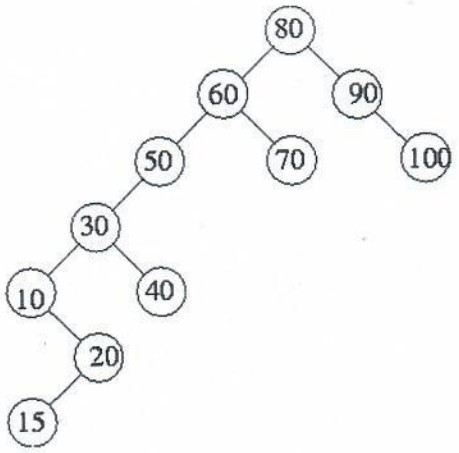

Fig.Q.5C